



AGRICULTURE IV

#01074

Description

This course develops agricultural skills necessary for employment, entrepreneurship, or further education in agriculture and agricultural occupations. Units may include: crop and livestock production, farm business management, agribusiness, horticulture, natural resources, agricultural mechanics, aquaculture, and water management. Leadership development and supervised agricultural experiences will also be emphasized. This course can be a continuation of Agriculture III or can be offered in alternating years with Agriculture III.

Grade 10-12

½ or 1 credit

Max Credit = 1

Standard 1	AGRICULTURE, FOOD, & NATURAL RESOURCES (AFNR) CLUSTER SKILLS	
Topic 1.2	<i>Evaluate the nature and scope of the Agriculture, Food, & Natural Resources Career Cluster and the role of agriculture, food, and natural resources (AFNR) in society and the economy.</i>	
	Student Competencies	
	1.2.2	EXAMINE THE COMPONENTS OF THE AFNR SYSTEMS AND ASSESS THEIR IMPACT ON THE LOCAL, STATE, NATIONAL, AND GLOBAL SOCIETY AND ECONOMY.
	1.2.2.4	Assess components within AFNR systems and analyze relationships between systems.
	1.2.2.5	Assess how people within societies on local, state, national, and global levels interact with AFNR systems on daily, monthly, or yearly basis.
	1.2.2.6	Assess the economic impact of an AFNR system on a local, state, national, and global level.
Topic 1.3	<i>Examine and summarize the importance of health, safety, and environmental management systems in AFNR workplaces.</i>	
	Student Competencies	
	1.3.1	IDENTIFY AND EXPLAIN THE IMPLICATIONS OF REQUIRED REGULATIONS TO MAINTAIN AND IMPROVE SAFETY, HEALTH, AND ENVIRONMENTAL MANAGEMENT SYSTEMS.
	1.3.1.3	Execute health, safety, and environmental procedures to comply with regulatory and safety standards.
	1.3.1.4	Analyze existing required regulations within an AFNR workplace.
	1.3.3	APPLY HEALTH AND SAFETY PRACTICES TO AFNR WORKPLACES.
	1.3.3.5	Analyze and evaluate the impact of current health and safety practices of AFNR workplaces.
	1.3.3.6	Assess various emergency response plan requirements for an AFNR workplaces and/or facility.
	1.3.3.7	Assess and apply first aid knowledge and procedures relevant to AFNR workplaces.
	1.3.3.8	Assess the safety priorities and select appropriate responses for different levels of contamination or injury at an AFNR workplace.
	1.3.4	USE APPROPRIATE PROTECTIVE EQUIPMENT AND DEMONSTRATE SAFE AND PROPER USE OF AFNR TOOLS AND EQUIPMENT.
	1.3.4.5	Complete the set up and adjustment for tools and equipment related to AFNR tasks.
	1.3.4.6	Assess and demonstrate appropriate operation, storage, and maintenance techniques for AFNR tools and equipment.
	1.3.4.7	Design and implement plans to ensure the use of appropriate protective equipment when using various AFNR tools and equipment.
	1.3.4.8	Evaluate and select appropriate tools and equipment to complete AFNR tasks.

Topic 1.5	<i>Describe career opportunities and means to achieve those opportunities in each of the Agriculture, Food, & Natural Resources career pathways.</i>	
	Student Competencies	
	1.5.1	EVALUATE AND IMPLEMENT THE STEPS AND REQUIREMENTS TO PURSUE A CAREER OPPORTUNITY IN EACH OF THE AFNR CAREER PATHWAYS (E.G., GOALS, DEGREES, CERTIFICATIONS, RESUMES, COVER LETTER, PORTFOLIOS, INTERVIEWS, ETC.).
	1.5.1.6	Assess personal goals, experiences, education, and skillsets and organize them to produce the appropriate tools and develop the skills to effectively communicate about one's qualifications for an AFNR career.
	1.5.1.7	Evaluate progress toward AFNR career goals and identify opportunities for improvement and necessary adjustments to one's plan of action.
	1.5.1.8	Implement one's personal plan of action for obtaining the required education, training, and experiences and evaluate progress to identify opportunities for improvement and necessary adjustments.
	1.5.1.9	Evaluate, update, and improve a set of personal tools to reflect current skills, experiences, education, goals, etc. and complete the processes needed to pursue and obtain a career in an AFNR pathway.
	1.5.2	EXAMINE AND CHOOSE CAREER OPPORTUNITIES THAT ARE MATCHED TO PERSONAL SKILLS, TALENTS, AND CAREER GOALS IN AN AFNR PATHWAY OF INTEREST.
	1.5.2.5	Interpret and evaluate the results of a personal career assessment and connect them to potential careers in AFNR pathways.
	1.5.2.6	Conduct interviews with career professionals within AFNR pathways and summarize the results.

Standard 2	AGRIBUSINESS SYSTEMS		
Topic 2.1	<i>Apply management planning principles in AFNR businesses.</i>		
	Student Competencies		
	2.1.1	APPLY MICRO- AND MACROECONOMIC PRINCIPLES TO PLAN AND MANAGE INPUTS AND OUTPUTS IN AN AFNR BUSINESS.	
	2.1.1.1	Examine and provide examples of microeconomic principles related to decisions about AFNR business inputs and outputs (e.g., supply, demand and equilibrium, elasticity, diminishing returns, opportunity cost, etc.).	
	2.1.1.2	Examine and provide examples of macroeconomic principles related to AFNR businesses (e.g., Gross Domestic Product, inflation, capital accounts, unemployment rate, etc.).	
	2.1.1.3	Define and research the nature of monetary policies in different global economic systems (e.g., traditional economic system, command economic system, market economic system, mixed economic system, etc.).	
	2.1.1.4	Apply microeconomic principles to calculate values associated with different inputs and outputs in AFNR businesses (e.g., price, point of equilibrium, opportunity costs, marginal costs, etc.).	
	2.1.1.5	Analyze and describe the relationship between AFNR business and industry outputs and domestic and global macroeconomic trends (e.g., Gross Domestic Product, national income, rate of growth, price levels, etc.).	
	2.1.1.6	Assess the monetary policy in different countries and explain how it impacts AFNR businesses.	
	2.1.2	READ, INTERPRET, EVALUATE AND WRITE STATEMENTS OF PURPOSE TO GUIDE BUSINESS GOALS, OBJECTIVES, AND RESOURCE ALLOCATION.	
	2.1.2.1	Read and interpret statements of purpose (e.g., vision, mission statement, charter, etc.).	
	2.1.2.2	Identify the meaning and importance of goals and objectives in AFNR business enterprises.	
	2.1.2.3	Assess different approaches for creating statements of purpose for AFNR businesses and choose an appropriate approach to meet organizational needs.	
	2.1.2.4	Prepare short-term, intermediate and long-term goals and objectives that are consistent with the statements of purpose for an AFNR business.	
	2.1.3	DEVISE AND APPLY MANAGEMENT SKILLS TO ORGANIZE AND RUN AN AFNR BUSINESS IN AN EFFICIENT, LEGAL, AND ETHICAL MANNER.	
	2.1.3.1	Define and provide examples of management skills used to organize an AFNR business (e.g., management types, organizational structures, time management techniques, conducting business agreements, etc.).	
	2.1.3.2	Identify and interpret appropriate local, state, federal, international, and industry regulations that impact the management and operation of AFNR businesses.	

		2.1.3.3	Identify and evaluate the presence or lack of ethical standards in planning and operating AFNR businesses.
		2.1.3.4	Analyze the effectiveness of different management skills used in an AFNR business.
		2.1.3.5	Assess and describe the positive and negative impact of local, state, federal, international, and industry regulations on the management and operation of AFNR businesses.
		2.1.3.6	Analyze the importance of using ethical standards and develop methods to communicate ethical standards within AFNR businesses.
Topic 2.2	<i>Use record keeping to accomplish AFNR business objectives, manage budgets, and comply with laws and regulations.</i>		
	Student Competencies		
	2.2.1	APPLY FUNDAMENTAL ACCOUNTING PRINCIPLES, SYSTEMS, TOOLS, AND APPLICABLE LAWS AND REGULATIONS TO RECORD, TRACK, AND AUDIT AFNR BUSINESS TRANSACTIONS (E.G., ACCOUNTS, DEBITS, CREDITS, ASSETS, LIABILITIES, EQUITY, ETC.).	
		2.2.1.4	Evaluate the implementation and appropriateness of accounting systems and procedures used for record keeping in AFNR businesses.
		2.2.1.5	Compare and contrast the benefits and limitations of different tools and services for recording, tracking, and auditing AFNR business transactions (e.g., convenience, costs, data security, etc.).
		2.2.1.6	Predict and calculate the consequences of non-compliance with laws and regulations related to recording, tracking, and auditing accounting information in AFNR businesses.
	2.2.2	ASSEMBLE, INTERPRET, AND ANALYZE FINANCIAL INFORMATION AND REPORTS TO MONITOR AFNR BUSINESS PERFORMANCE AND SUPPORT DECISION-MAKING (E.G., INCOME STATEMENTS, BALANCE SHEETS, CASH-FLOW ANALYSIS, INVENTORY REPORTS, BREAK-EVEN ANALYSIS, RETURN ON INVESTMENT, TAXES, ETC.).	
		2.2.2.4	Prepare and interpret financial reports to describe the performance of AFNR businesses (e.g., efficiency, profitability, net worth, financial ratios, working capital ratio, leverage, etc.).
		2.2.2.5	Use accounting information to prepare financial reports associated with inventory in AFNR businesses (e.g., cost of goods sold, margins on goods, etc.).
		2.2.2.6	Analyze and describe reporting requirements for different types of taxes paid by AFNR businesses (e.g., income, property, sales, employment, etc.).
		2.2.2.7	Recommend appropriate financial reports to assemble to support specific AFNR business decisions (e.g., evaluating efficiency, profitability, net worth, financial ratios, etc.).
		2.2.2.8	Create recommendations to improve management of inventory in AFNR businesses (e.g., maintaining optimal levels, calculating costs of carrying input and output inventory, supply chain management, etc.).
		2.2.2.9	Assemble financial information to prepare tax filings for AFNR businesses.

Topic 2.4		<i>Develop a business plan for an AFNR business.</i>	
		Student Competencies	
	2.4.1	ANALYZE CHARACTERISTICS AND PLANNING REQUIREMENTS ASSOCIATED WITH DEVELOPING BUSINESS PLANS FOR DIFFERENT TYPES OF AFNR BUSINESSES.	
	2.4.1.1	Describe the meaning, importance, and economic impact of entrepreneurship on the AFNR industry and larger economy.	
	2.4.1.2	Categorize the characteristics of the types of ownership structures used in AFNR businesses (e.g., sole proprietorships, cooperatives, partnerships, and corporations).	
	2.4.1.3	Research and describe the components to include in a business plan for an AFNR business.	
	2.4.1.4	Classify the characteristics of successful entrepreneurs in AFNR businesses.	
	2.4.1.5	Compare and contrast business plans for different types of ownership structures used in AFNR businesses.	
	2.4.1.6	Analyze the information needed and strategies to obtain the information to complete an AFNR business plan (e.g., SMART goals and objectives, needs assessment, cash flow projection, etc.).	
	2.4.2	DEVELOP PRODUCTION AND OPERATIONAL PLANS FOR AN AFNR BUSINESS.	
	2.4.2.1	Identify and define the components of operational plans in AFNR businesses (e.g., location, supply and inventory management, production and distribution, organization structure, etc.).	
	2.4.2.2	Devise strategies to illustrate the production process of an AFNR business to produce a specific agricultural product.	
	2.4.2.3	Compare and contrast the strengths and weaknesses of operational plans from different AFNR businesses to determine best practices.	
	2.4.2.4	Identify and assess alternative production systems for a specific agricultural product.	
	2.4.3	IDENTIFY AND APPLY STRATEGIES TO MANAGE OR MITIGATE RISK.	
	2.4.3.1	Assess and classify sources of risk for an AFNR business (e.g., financial risk, public perception of company, etc.).	
	2.4.3.2	Research and summarize examples that illustrate the importance of risk and uncertainty within AFNR businesses.	
	2.4.3.3	Risk management strategies for AFNR businesses (e.g., cash flow projection, analyze market trends, etc.).	
	2.4.3.4	Analyze alternative approaches to reducing risk for AFNR businesses (e.g., insurance for product liability, property, production, or income loss for personnel life and health, etc.).	

Standard 3	ANIMAL SYSTEMS	
Topic 3.4	<i>Apply principles of animal reproduction to achieve desired outcomes for performance, development, and/or economic production.</i>	
	Student Competencies	
	3.4.1	EVALUATE ANIMALS FOR BREEDING READINESS AND SOUNDNESS.
	3.4.1.4	Analyze the functions of major organs in the male and female reproductive systems.
	3.4.1.5	Assess and describe factors that lead to reproductive maturity.
	3.4.1.6	Evaluate reproductive problems that occur in animals.
	3.4.1.7	Select breeding animals based on characteristics of the reproductive organs.
	3.4.1.8	Evaluate and select animals for reproductive readiness.
	3.4.1.9	Treat or cull animals with reproductive problems.
	3.4.2	APPLY SCIENTIFIC PRINCIPLES TO SELECT AND CARE FOR BREEDING ANIMALS.
	3.4.2.5	Compare and contrast the use of genetically superior animals in the production of animals and animal products.
	3.4.2.6	Demonstrate how to determine probability trait inheritance in animals.
	3.4.2.7	Analyze how DNA analysis can detect genetic defects in breeding stock.
	3.4.2.8	Analyze the care needs for breeding stock in each stage of growth.
	3.4.2.9	Select and evaluate a breeding system based on the principles of genetics.
	3.4.2.10	Select and evaluate breeding animals and determine the probability of a given trait in their offspring.
	3.4.2.11	Perform a DNA analysis and use the data to make and defend breeding decisions.
	3.4.2.12	Create a plan to differentiate care of a species of breeding animals throughout their growth stages.
	3.4.3	APPLY SCIENTIFIC PRINCIPLES TO BREED ANIMALS.
	3.4.3.4	Examine the use of quantitative breeding values (e.g., EPDs, Performance records, pedigrees) in the selection of genetically superior breeding stock.
	3.4.3.5	Calculate the potential economic benefits of natural versus artificial breeding methods.
	3.4.3.6	Demonstrate artificial insemination techniques.
	3.4.3.7	Analyze the processes of major reproductive management practices, including estrous synchronization, superovulation, flushing, and embryo transfer.
	3.4.3.8	Compare and contrast quantitative breeding value differences between genetically superior animals and animals of average genetic value.
	3.4.3.9	Select animal breeding methods based on reproductive and economic efficiency.
	3.4.3.10	Evaluate the implementation and effectiveness of artificial insemination techniques.
	3.4.3.11	Create and evaluate plans and procedures for estrous synchronization, superovulation, flushing, embryo transfer, and other reproductive management practices.

	3.4.3.12	Select and assess animal performance based on quantitative breeding values for specific characteristics.
Topic 3.6	<i>Classify, evaluate, and select animals based on anatomical and physiological characteristics.</i>	
	Student Competencies	
	3.6.1	CLASSIFY ANIMALS ACCORDING TO TAXONOMIC CLASSIFICATION SYSTEMS AND USE (E.G. AGRICULTURAL, COMPANION, ETC.).
	3.6.1.6	Analyze the visual characteristics of an animal or animal product and select correct classification terminology when referring to companion and production animals.
	3.6.1.7	Assess taxonomic characteristics and classify animals according to the taxonomic classification system.
	3.6.1.8	Recommend different uses for an animal species based upon an analysis of local market needs.
	3.6.1.9	Apply knowledge of classification terms to communicate with others about animal systems in an effective and accurate manner.
	3.6.3	SELECT AND TRAIN ANIMALS FOR SPECIFIC PURPOSES AND MAXIMUM PERFORMANCE BASED ON ANATOMY AND PHYSIOLOGY.
	3.6.3.7	Evaluate and select animals to maximize performance based on anatomical and physiological characteristics that affect health, growth, and reproduction.
	3.6.3.8	Choose, implement, and evaluate sustainable and efficient procedures (e.g., selection, housing, nutrition, and management) to produce consistently high-quality animals that are well suited for their intended purposes.
	3.6.3.9	Evaluate and select animals to produce superior animal products based on industry standards.

Standard 4	BIOTECHNOLOGY SYSTEMS	
Topic 4.2	<i>Demonstrate proficiency by safely applying appropriate laboratory skills to complete tasks in a biotechnology research and development environment (e.g., standard operating procedures, record keeping, aseptic technique, equipment maintenance, etc.).</i>	
	Student Competencies	
	4.2.3	APPLY STANDARD OPERATING PROCEDURES FOR THE SAFE HANDLING OF BIOLOGICAL AND CHEMICAL MATERIALS IN A LABORATORY.
	4.2.3.4	Demonstrate advanced aseptic techniques in the laboratory (e.g., sterile work area, sterile handling, personal hygiene, etc.).
	4.2.3.5	Analyze and select an appropriate standard operating procedure for working with biological materials based upon their classification.
	4.2.3.6	Formulate and prepare solutions using standard operating procedures (e.g., proper labeling, storage, etc.).
Topic 4.3	<i>Demonstrate the application of biotechnology to solve problems in Agriculture, Food, and Natural Resources (AFNR) systems (e.g., bioengineering, food processing, waste management, horticulture, forestry, livestock, crops, etc.).</i>	
	Student Competencies	
	4.3.3	APPLY BIOTECHNOLOGY PRINCIPLES, TECHNIQUES, AND PROCESSES TO PROTECT THE ENVIRONMENT AND MAXIMIZE USE OF NATURAL RESOURCES (E.G., BIOMASS, BIOPROSPECTING, INDUSTRIAL BIOTECHNOLOGY, ETC.).
	4.3.3.1	Examine the consequences of agricultural practices on natural populations.
	4.3.3.2	Define and summarize industrial biotechnology and categorize the benefits and risks associated with its use in manufacturing (e.g., fabrics, plastics, etc.).
	4.3.3.3	Research and summarize the potential applications of bioprospecting in biotechnology and agriculture.
	4.3.3.4	Analyze how biotechnology can be used to monitor the effects of agricultural practices on natural populations.
	4.3.3.5	Apply the processes used in the production of molecules for use in industrial applications.
	4.3.3.6	Assess and document the pros and cons of bioprospecting to achieve a research or product development objective.
	4.3.3.7	Evaluate the impact of modified organisms on the natural environment.
	4.3.3.8	Monitor and evaluate processes used in the synthesis of a molecule.
	4.3.3.9	Propose opportunities to use bioprospecting after weighing the short-term and long-term impacts on the environment.

	4.3.5	APPLY BIOTECHNOLOGY PRINCIPLES, TECHNIQUES, AND PROCESSES TO PRODUCE BIOFUELS (E.G., FERMENTATION, TRANSESTERIFICATION, METHANOGENESIS, ETC.).	
	4.3.5.1	Examine and synthesize the need for biofuels (e.g., cellulosic bioenergy, etc.).	
	4.3.5.2	Differentiate between biomass and sources of biomass.	
	4.3.5.3	Research and explain the process of fermentation and its potential applications.	
	4.3.5.4	Define and summarize the process of transesterification and its potential applications.	
	4.3.5.5	Examine the process of methanogenesis and its potential applications.	
	4.3.5.6	Analyze the impact of the production and use of biofuels on the environment.	
	4.3.5.7	Assess the characteristics of biomass that make it useful for biofuels production.	
	4.3.5.8	Correlate the relationship between fermentation and the process used to produce alcohol from biomass.	
	4.3.5.9	Analyze and document the process used to produce biodiesel from biomass.	
	4.3.5.10	Analyze and describe the process used to produce methane from biomass.	
	4.3.5.11	Evaluate and support how biofuels could solve a global issue (e.g., environmental, agricultural, etc.).	
	4.3.5.12	Conduct a review of the technologies used to create biofuels from biomass and weigh the pros and cons of each method.	
	4.3.5.13	Produce alcohol and co-products from biomass.	
	4.3.5.14	Produce biodiesel and co-products from biomass.	
	4.3.5.15	Produce methane and co-products from biomass.	
	4.3.6	APPLY BIOTECHNOLOGY PRINCIPLES, TECHNIQUES, AND PROCESSES TO IMPROVE WASTE MANAGEMENT (E.G., GENETICALLY MODIFIED ORGANISMS, BIOREMEDIATION, ETC.).	
	4.3.6.1	Compare and contrast the use of natural organisms and genetically-engineered organisms in the treatment of wastes.	
	4.3.6.2	Summarize the purpose of microorganisms in biological waste management.	
	4.3.6.3	Analyze the role of microorganisms in industrial chemical waste treatment.	
	4.3.6.4	Provide examples of instances in which bioremediation can be applied to clean up environmental contaminants.	
	4.3.6.5	Analyze the process by which organisms are genetically engineered for waste treatment.	
	4.3.6.6	Assess and describe the processes involved in biotreatment of biological wastes.	
	4.3.6.7	Evaluate and describe the processes involved in biotreatment of industrial chemical wastes.	
	4.3.6.8	Analyze and summarize the risks and benefits of using biotechnology for bioremediation.	

Standard 5	ENVIRONMENTAL SERVICE SYSTEMS	
Topic 5.3	<i>Develop proposed solutions to environmental issues, problems, and applications using scientific principles of meteorology, soil science, hydrology, microbiology, chemistry, and ecology.</i>	
	Student Competencies	
	5.3.1	APPLY METEOROLOGY PRINCIPLES TO ENVIRONMENTAL SERVICE SYSTEMS.
	5.3.1.1	Distinguish between the different components and structural layers of the earth's atmosphere.
	5.3.1.2	Analyze how meteorological conditions influence air quality.
	5.3.1.3	Research climate change and summarize evidence that climate change is occurring.
	5.3.1.4	Examine and summarize factors that affect the earth's balance of energy.
	5.3.1.5	Differentiate how components of the atmosphere (e.g., weather systems and patterns, structure of the atmosphere, etc.) affect environmental service systems.
	5.3.1.6	Analyze and articulate the relationship between meteorological conditions, air quality, and air pollutants.
	5.3.1.7	Assess the environmental, economic, and social consequences of climate change.
	5.3.1.8	Analyze the basics of the greenhouse effect and describe how the greenhouse effect alters the earth's balance of energy.
	5.3.1.9	Utilize meteorological data to assess the impact of atmospheric conditions on environmental service systems.
Topic 5.4	<i>Demonstrate the operation of environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management, and energy conservation).</i>	
	Student Competencies	
	5.4.1	USE POLLUTION CONTROL MEASURES TO MAINTAIN A SAFE FACILITY AND ENVIRONMENT.
	5.4.1.1	Identify and distinguish types of pollution and distinguish between point source and nonpoint source pollution.
	5.4.1.2	Research ways in which pollution can be managed and prevented and propose solutions to meet the needs of local systems.
	5.4.1.3	Interpret the conditions necessary for waste to be labeled as hazardous.
	5.4.1.4	Assess how industrial and nonindustrial pollution has damaged the environment.
	5.4.1.5	Conduct tests to determine the presence and extent of pollution.
	5.4.1.6	Classify examples of pollution as hazardous or nonhazardous.
	5.4.4	COMPARE AND CONTRAST THE IMPACT OF CONVENTIONAL AND ALTERNATIVE ENERGY SOURCES ON THE ENVIRONMENT AND OPERATION OF ENVIRONMENTAL SERVICE SYSTEMS.
	5.4.4.1	Research conventional energy sources and list conservation measures to reduce the impact on environmental service systems.

	5.4.4.2	Research alternative energy sources and describe the motivations for seeking alternatives to conventional energy sources as they relate to environmental monitoring.
	5.4.4.3	Examine the factors that affect energy consumption and describe how these factors are related to environmental monitoring.
	5.4.4.4	Research the impact on environmental service systems that occur because of energy consumption.
	5.4.4.5	Examine and explain how energy consumption and the carbon cycle relate to environmental monitoring.
	5.4.4.6	Research and describe the purpose and applications of life cycle assessments to environmental service systems.
	5.4.4.7	Assess the advantages and disadvantages of conventional energy sources in regards to environmental service systems.
	5.4.4.8	Identify advantages and disadvantages of alternative energy sources as they pertain to environmental service systems.
	5.4.4.9	Analyze and document the main categories of energy consumption.
	5.4.4.10	Analyze and document the most significant impacts that energy consumption has on environmental monitoring.
	5.4.4.11	Calculate the impact of the carbon cycle imbalance (due to energy consumption) and assess how this imbalance affects environmental service systems.
	5.4.4.12	Interpret a life cycle assessment and explain how it can be utilized in environmental service systems to assess the potential ecological impact of an energy source.
	5.4.4.13	Evaluate the impact burning of fossil fuels has on environmental service systems.
	5.4.4.14	Evaluate the impact alternative energy sources have on environmental conditions.
	5.4.4.15	Evaluate strategies for reducing energy consumption to determine the most effective course of action based on the needs of environmental service systems.
Topic 5.5	<i>Use tools, equipment, machinery, & technology common to tasks in environmental service systems.</i>	
	Student Competencies	
	5.5.2	PERFORM ASSESSMENTS OF ENVIRONMENTAL CONDITIONS USING EQUIPMENT, MACHINERY, AND TECHNOLOGY.
	5.5.2.3	Research and summarize methods and tools used to determine air quality and determine if pollution is present (e.g., CO2 probe, particulate matter sampler, etc.).
	5.5.2.4	Research and summarize methods used to determine ecological health and determine if an ecosystem is threatened (e.g., quadrat analysis, bioindicators, mark-recapture, etc.).
	5.5.2.7	Assess different measurements of air quality (e.g., ozone, carbon monoxide, particulate matter, etc.) to determine their effectiveness and limitations.
	5.5.2.11	Perform an evaluation of air quality to determine and assess its impact of human and ecological populations.
	5.5.2.12	Evaluate a habitat to determine its ecological quality and if it is threatened.

Standard 6	FOOD PRODUCTS AND PROCESSING SYSTEMS	
Topic 6.1	<i>Develop and implement procedures to ensure safety, sanitation, and quality in food product and processing facilities.</i>	
	Student Competencies	
	6.1.1	ANALYZE AND MANAGE OPERATIONAL AND SAFETY PROCEDURES IN FOOD PRODUCTS AND PROCESSING FACILITIES.
	6.1.1.3	Analyze and document attributes and procedures of current safety programs in food products and processing facilities.
	6.1.1.4	Assess specifications and maintenance needs for equipment and facilities used in food products and processing systems (e.g., specifications for machines, sanitation procedures, repair protocol, etc.).
	6.1.2	APPLY FOOD SAFETY AND SANITATION PROCEDURES IN THE HANDLING AND PROCESSING OF FOOD PRODUCTS TO ENSURE FOOD QUALITY.
	6.1.2.5	Outline procedures to eliminate possible contamination hazards associated with food products and processing.
	6.1.2.6	Construct plans that ensure implementation of safe handling procedures on food products.
	6.1.2.7	Design and construct experiments for quality assurance tests on food products.
	6.1.2.8	Explain, document, and execute the procedures of microbiological tests used to detect food-borne pathogens.
	6.1.2.9	Identify sources of contamination in food products and/or processing facilities and develop ways to eliminate contamination.
	6.1.2.10	Examine, interpret, and report outcomes from safe handling procedures and results from quality assurance tests.
	6.1.2.11	Interpret and evaluate results of quality assurance tests on food products and examine steps to implement corrective procedures.
	6.1.2.12	Conduct and interpret microbiological tests for food-borne pathogens.
Topic 6.3	<i>Select and process food products for storage, distribution, and consumption.</i>	
	Student Competencies	
	6.3.1	IMPLEMENT SELECTION, EVALUATION AND INSPECTION TECHNIQUES TO ENSURE SAFE AND QUALITY FOOD PRODUCTS.
	6.3.1.1	Summarize characteristics of quality and yield grades of food products.
	6.3.1.2	Summarize procedures to select raw food products based on yield grades and quality grades.

	6.3.1.3	Identify and describe protocols for inspection and harvesting techniques for animal food products (e.g., pre-mortem and post-mortem inspections, Food Safety Inspection Service guidelines (FSIS), etc.).
	6.3.1.4	Identify and describe foods derived from different classifications of food products (e.g., meat, egg, poultry, fish, dairy, fruits, vegetables, grains, legumes, oilseeds, etc.).
	6.3.1.5	Analyze factors that affect quality and yield grades of food products.
	6.3.1.6	Assemble procedures to perform quality-control inspections of raw food products for processing.
	6.3.1.7	Examine and evaluate inspection and harvesting of animals using regulatory agency approved or industry-approved techniques.
	6.3.1.8	Examine and summarize desirable qualities of food products derived from different classifications of food products.
	6.3.1.9	Outline procedures to assign quality and yield grades to food products according to industry standards.
	6.3.1.10	Develop, apply, and evaluate care and handling procedures to maintain original food quality and yield.
	6.3.1.11	Examine and respond to consumer concerns about the inspection and harvesting techniques of animals using accurate information based on regulatory agency approved or industry-approved techniques.
	6.3.1.12	Evaluate and grade food products from different classifications of food products.
	6.3.2	DESIGN AND APPLY TECHNIQUES OF FOOD PROCESSING, PRESERVATION, PACKAGING, AND PRESENTATION FOR DISTRIBUTION AND CONSUMPTION OF FOOD PRODUCTS.
	6.3.2.1	Identify and explain English and metric measurements used in the food products and processing industry.
	6.3.2.2	Differentiate between methods and materials used for processing food for different markets (e.g., fresh food products, ready to eat food products, etc.).
	6.3.2.3	Identify methods of food preservation and give examples of foods preserved by each method.
	6.3.2.4	Summarize types of materials and methods used in food packaging and presentation.
	6.3.2.5	Compare weights and measurements of products and perform conversions between units of measure.
	6.3.2.6	Outline appropriate methods and prepare foods for sale and distribution for different markets.
	6.3.2.7	Analyze and document food preservation processes and methods on a variety of food products.
	6.3.2.8	Analyze the degree of desirable food qualities of foods stored in various packaging.
	6.3.2.9	Design plans to formulate and package food products using a variety of weights and measures.
	6.3.2.10	Evaluate food quality factors on foods prepared for different markets (e.g., shelf life, shrinkage, appearance, weight, etc.).
	6.3.2.11	Devise and apply strategies to preserve different foods using various methods and techniques.
	6.3.2.12	Construct and implement methods of selecting packaging materials to store a variety of food products.

Standard 7	NATURAL RESOURCE SYSTEMS	
Topic 7.4	<i>Use GIS data for a given area to devise a management plan for the management, conservation, improvement, and enhancement of its natural resources.</i>	
	Student Competencies	
	7.4.1	DEMONSTRATE NATURAL RESOURCE PROTECTION, MAINTENANCE, ENHANCEMENT, AND IMPROVEMENT TECHNIQUES.
	7.4.1.1	Identify and categorize different kinds of streams.
	7.4.1.2	Identify and categorize characteristics of a healthy forest.
	7.4.1.3	Identify and categorize characteristics of a healthy wildlife habitat.
	7.4.1.4	Identify and categorize characteristics of healthy rangeland.
	7.4.1.5	Identify and categorize characteristics of natural resources that make them desirable for recreational purposes.
	7.4.1.6	Identify and categorize characteristics of healthy marine and coastal natural resources.
	7.4.1.7	Assess and explain indicators of the biological health of a stream.
	7.4.1.8	Assess and apply the methods used to improve a forest stand.
	7.4.1.9	Assess and apply methods of wildlife habitat improvement.
	7.4.1.10	Assess and apply methods of rangeland improvement.
	7.4.1.11	Assess and apply management techniques for improving outdoor recreation opportunities.
	7.4.1.12	Assess and apply methods to improve marine and coastal natural resources.
	7.4.2	DIAGNOSE PLANT AND WILDLIFE DISEASES AND FOLLOW PROTOCOLS TO PREVENT THEIR SPREAD.
	7.4.2.1	Classify causes of diseases in plants and the correct authorities to whom some diseases should be reported.
	7.4.2.2	Classify causes of diseases in wildlife and aquatic species and determine the correct authorities to whom some diseases should be reported.
	7.4.2.3	Analyze a plant disease based on its symptoms, identify if the disease needs to be reported to authorities, and determine to which authorities it should be reported.
	7.4.2.4	Analyze a wildlife or aquatic species disease based on its symptoms, identify if the disease needs to be reported to authorities, and determine to which authorities it should be reported.
	7.4.3	PREVENT OR MANAGE INTRODUCTION OF ECOLOGICALLY HARMFUL SPECIES IN A PARTICULAR REGION.
	7.4.3.1	Categorize harmful and beneficial insects, as well as signs of insect damage to natural resources.
	7.4.3.2	Identify and classify invasive species common to a particular region.

	7.4.3.3	Research and summarize strategies and benefits of preventing the introduction of harmful species to a particular region.
	7.4.3.4	Analyze signs of insect infestation, identify if it needs to be reported to authorities, and determine to which authorities it should be reported.
	7.4.3.5	Analyze signs of the spread of invasive species, identify if it needs to be reported to authorities, and determine to which authorities it should be reported.
	7.4.3.6	Assess and implement a plan for preventing the spread of harmful species for its effectiveness.
	7.4.4	MANAGE FIRES IN NATURAL RESOURCE SYSTEMS.
	7.4.4.1	Differentiate between desirable and undesirable fires and research the role fire plays in a healthy ecosystem.
	7.4.4.2	Research and summarize how fire management techniques have evolved.
	7.4.4.3	Assess and apply techniques used to fight wildfires, manage prescribed fires, and ensure human safety.
	7.4.4.4	Assess the effectiveness of techniques previously & currently used to prevent harmful fires.

Standard 8	PLANT SYSTEMS	
Topic 8.1	<i>Develop and implement a crop management plan for a given production goal that accounts for environmental factors.</i>	
	Student Competencies	
	8.1.1	DETERMINE THE INFLUENCE OF ENVIRONMENTAL FACTORS ON PLANT GROWTH.
	8.1.1.4	Analyze and describe plant responses to light color, intensity, and duration.
	8.1.1.5	Determine the optimal air and temperature conditions for plant growth.
	8.1.1.6	Analyze and describe plant responses to water conditions.
	8.1.1.7	Analyze plant responses to varied light color, intensity, and duration and recommend modifications to light for desired plant growth.
	8.1.1.8	Design, implement, and evaluate a plan to maintain optimal air and temperature conditions for plant growth.
	8.1.1.9	Analyze plant responses to water conditions and recommend modifications to water for desired plant growth.
	8.1.2	PREPARE AND MANAGE GROWING MEDIA FOR USE IN PLANT SYSTEMS.
	8.1.2.4	Discuss how soil drainage and water-holding capacity can be improved.
	8.1.2.5	Formulate and prepare growing media for specific plants or crops.
	8.1.2.6	Determine the hydraulic conductivity for soil and how the results influence irrigation practices.

	8.1.3	DEVELOP AND IMPLEMENT A FERTILIZATION PLAN FOR SPECIFIC PLANTS OR CROPS.	
		8.1.3.7	Analyze the effects of nutrient deficiencies and symptoms and recognize environmental causes of nutrient deficiencies.
		8.1.3.8	Contrast pH and cation exchange capacity between mineral soil and soilless growing media.
		8.1.3.9	Interpret laboratory analyses of soil and tissue samples.
		8.1.3.10	Calculate the amount of fertilizer to be applied based on nutrient recommendation and fertilizer analysis.
		8.1.3.11	Assess and describe the shorthand long-term effects production methods have on soil.
		8.1.3.12	Assess and describe the impact environmental factors have on a crop.
		8.1.3.13	Monitor plants for signs of nutrient deficiencies and prepare a scouting report to correct elements negatively affecting plant growth in a field or greenhouse.
		8.1.3.14	Adjust the pH of growing media for specific plants or crops.
		8.1.3.15	Prescribe fertilizer applications based on the results of a laboratory analysis of soil and plant tissue samples.
		8.1.3.16	Calibrate application equipment to meet plant nutrient needs.
Topic 8.2	<i>Apply principles of classification, plant anatomy, and plant physiology to plant production and management.</i>		
	Student Competencies		
	8.2.3	APPLY KNOWLEDGE OF PLANT PHYSIOLOGY AND ENERGY CONVERSION TO PLANT SYSTEMS.	
		8.2.3.11	Evaluate the impact of photosynthesis and the factors that affect it on plant management, culture, and production problems.
		8.2.3.12	Evaluate the impact of plant respiration on plant growth, crop management, and post-harvest handling decisions.
		8.2.3.13	Relate the principles of primary and secondary growth to plant systems.
		8.2.3.14	Select and defend the use of specific plant growth regulators to produce desired responses from plants.
Topic 8.3	<i>Propagate, culture, and harvest plants and plant products based on current industry standards.</i>		
	Student Competencies		
	8.3.1	DEMONSTRATE PLANT PROPAGATION TECHNIQUES IN PLANT SYSTEM ACTIVITIES.	
		8.3.1.1	Identify examples of and summarize pollination, cross-pollination, and self-pollination of flowering plants.
		8.3.1.2	Demonstrate sowing techniques for providing favorable conditions to meet the factors of seed germination.
		8.3.1.3	Summarize optimal conditions for asexual propagation and demonstrate techniques used to propagate plants by cuttings, division, separation, layering, budding, and grafting.
		8.3.1.4	Define micropropagation, discuss advantages associated with the practice, and summarize the main stages of the process.

	8.3.1.5	Summarize the principles of recombinant DNA technology and the basic steps in the process.
	8.3.1.6	Examine and apply the process of plant pollination and/or fertilization.
	8.3.1.7	Handle seed to overcome seed dormancy mechanisms and to maintain seed viability and vigor.
	8.3.1.8	Manage the plant environment to support asexual reproduction.
	8.3.1.9	Demonstrate aseptic micropropagation techniques.
	8.3.1.10	Compare and contrast the potential risks and advantages associated with genetically modified plants.
	8.3.1.11	Select and defend the use of pollination methods and practices used to maximize crop pollination.
	8.3.1.12	Conduct tests associated with seed germination rates, viability, and vigor.
	8.3.1.13	Evaluate asexual propagation practices based on productivity and efficiency.
	8.3.1.14	Propagate plants by micropropagation.
	8.3.1.15	Evaluate the impact of using genetically modified crops on other production practices.
	8.3.2	DEVELOP AND IMPLEMENT A MANAGEMENT PLAN FOR PLANT PRODUCTION.
	8.3.2.1	Research and summarize the importance of starting with pest- and disease-free propagation material.
	8.3.2.2	List and summarize the reasons for preparing growing media before planting.
	8.3.2.3	Determine seeding rate need for specified plant population or desired quantity of finished plants.
	8.3.2.4	Observe and record environmental conditions during the germination, growth, and development of a crop.
	8.3.2.5	Summarize the stages of plant growth and the reasons for controlling plant growth.
	8.3.2.6	Identify and categorize structures and technologies used for controlled atmosphere production of plants.
	8.3.2.7	Summarize the use of hydroponic and aquaponic systems for plant production.
	8.3.2.8	Inspect propagation material for evidence of pests or disease.
	8.3.2.9	Prepare soil and growing media for planting with the addition of amendments.
	8.3.2.10	Apply pre-plant treatments required of seeds and plants and evaluate the results.
	8.3.2.11	Monitor the progress of plantings and determine the need to adjust environmental conditions.
	8.3.2.12	Demonstrate proper techniques to control and manage plant growth through mechanical, cultural, or chemical means.
	8.3.2.13	Compare and contrast the types of technologies used for controlled atmosphere production.
	8.3.2.14	Compare and contrast the types of systems used in hydroponic and aquaponic plant production.
	8.3.2.15	Produce pest- and disease-free propagation material.
	8.3.3	DEVELOP AND IMPLEMENT A PLAN FOR INTEGRATED PEST MANAGEMENT FOR PLANT PRODUCTION.
	8.3.3.1	Identify and categorize plant pests, diseases, and disorders.
	8.3.3.2	Diagram the life cycle of major plant pests and diseases.
	8.3.3.3	Identify and summarize pest control strategies associated with integrated pest management and the importance of determining economic threshold.

	8.3.3.4	Distinguish between risks and benefits associated with the materials and methods used in plant pest management.
	8.3.3.5	Identify and analyze major local weeds, insect pests, and infectious and noninfectious plant diseases.
	8.3.3.6	Predict pest and disease problems based on environmental conditions and life cycles.
	8.3.3.7	Demonstrate pesticide formulations including organic and synthetic active ingredients and selection of pesticide to control specific pest.
	8.3.3.8	Examine and apply procedures for the safe handling, use, and storage of pesticides including personal protective equipment and reentry interval.
	8.3.3.9	Devise solutions for plant pests, diseases, and disorders.
	8.3.3.10	Design and implement a crop scouting program.
	8.3.3.11	Employ pest management strategies to manage pest populations, assess the effectiveness of the plan and adjust the plan as needed.
	8.3.3.12	Evaluate environmental and consumer concerns regarding pest management strategies.
	8.3.4	APPLY PRINCIPLES AND PRACTICES OF SUSTAINABLE AGRICULTURE TO PLANT PRODUCTION.
	8.3.4.1	Compare and contrast the alignment of different production systems (conventional and organic) with USDA sustainable practices criteria.
	8.3.4.2	Summarize national/international and local/regional food production systems.
	8.3.4.3	Identify and summarize impacts of environmental conditions on plants.
	8.3.4.4	Analyze the alignment of modern technologies used in production systems (e.g., precision agriculture, GE crops, etc.) with USDA sustainable practices criteria.
	8.3.4.5	Compare and contrast the impact on greenhouse gas, carbon footprint of the national/international production system with local/regional production system markets.
	8.3.4.6	Compare and contrast differing research conclusions related to environmental factors and their effect on plants.
	8.3.5	HARVEST, HANDLE, AND STORE CROPS ACCORDING TO CURRENT INDUSTRY STANDARDS.
	8.3.5.1	Identify and summarize harvesting methods and equipment.
	8.3.5.2	Research and summarize reasons for calculating crop loss and or damage.
	8.3.5.3	Research and summarize how safety is ensured at each stage of the following processes: harvesting, processing, and storing.
	8.3.5.4	Identify and categorize plant preparation methods for storing and shipping plants and plant products.
	8.3.5.5	Summarize the reasons for preparing plants and plant products for distribution.
	8.3.5.6	Assess the stage of growth to determine crop maturity or marketability and demonstrate proper harvesting techniques.
	8.3.5.7	Evaluate crop yield and loss data and make recommendations to reduce crop loss.
	8.3.5.8	Research and analyze practices used to maintain a safe product through harvest, processing, storage, and shipment (e.g., Food Safety Modernization Act, Good Agricultural Practices, etc.).

	8.3.5.9	Analyze the proper conditions required to maintain the quality of plants and plant products held in storage and during shipping.
	8.3.5.10	Demonstrate techniques for grading, handling, and packaging plants and plant products for distribution.

Standard 9 POWER, STRUCTURAL, AND TECHNICAL SYSTEMS		
Topic 9.2	<i>Operate and maintain AFNR mechanical equipment and power systems.</i>	
	Student Competencies	
	9.2.2	OPERATE MACHINERY AND EQUIPMENT WHILE OBSERVING ALL SAFETY PRECAUTIONS IN AFNR SETTINGS.
	9.2.2.5	Perform pre-operation inspections, start-up, & shut-down procedures on equipment, machinery, and power units as specified in owner's manuals.
	9.2.2.6	Adjust equipment, machinery, and power units for safe and efficient operation in AFNR power, structural, and technical systems.
Topic 9.3	<i>Service and repair AFNR mechanical equipment and power systems.</i>	
	Student Competencies	
	9.3.1	TROUBLESHOOT, SERVICE, AND REPAIR COMPONENTS OF INTERNAL COMBUSTION ENGINES USING MANUFACTURERS' GUIDELINES.
	9.3.1.1	Identify and classify components of internal combustion engines used in AFNR power, structural, and technical systems.
	9.3.1.2	Distinguish the characteristics of spark-and-compression internal combustion engines used in AFNR power, structural, and technical systems.
	9.3.1.3	Analyze and explain how the components of internal combustion engines interrelate during operation.
	9.3.1.4	Utilize technical manuals and diagnostic tools to determine service and repair needs of spark-and-compression internal combustion engines used in AFNR power, structural, and technical systems.
	9.3.1.5	Evaluate service and repair needs for internal combustion engines using a variety of performance tests (e.g., manuals, computer-based diagnostics, etc.).
	9.3.1.6	Inspect, analyze and repair spark-and-compression internal combustion engines used in AFNR power, structural, and technical systems.

	9.3.3	UTILIZE MANUFACTURERS' GUIDELINES TO DIAGNOSE AND TROUBLESHOOT MALFUNCTIONS IN MACHINERY, EQUIPMENT, AND POWER SOURCE SYSTEMS (E.G., HYDRAULIC, PNEUMATIC, TRANSMISSION, STEERING, SUSPENSION, ETC.).	
	9.3.3.1	Research and summarize the applications of common types of hydraulic and pneumatic systems used in AFNR power, structural, and technical systems.	
	9.3.3.2	Compare and contrast operation principles and features of mechanical transmission systems used in AFNR power, structural, and technical systems (e.g., belts, chains, gears, bearings, seals, universals, drive shafts, etc.).	
	9.3.3.3	Identify and examine the components of suspension and steering systems used in AFNR power, structural, and technical systems.	
	9.3.3.4	Analyze and interpret hydraulic and pneumatic system symbols and diagrams used in AFNR power, structural and technical systems.	
	9.3.3.5	Utilize speed, torque, and power measurements to calculate efficiency in power transmission systems used in AFNR power, structural, and technical systems.	
	9.3.3.6	Assess and analyze vehicle and machinery performance related to suspension and steering systems used in AFNR power, structural, and technical systems.	
	9.3.3.7	Inspect, analyze, and repair hydraulic and pneumatic system components used in AFNR power, structural, and technical systems.	
	9.3.3.8	Inspect, analyze, and repair the components of power transmission systems used in AFNR power, structural, and technical systems.	
	9.3.3.9	Inspect, analyze, and repair vehicle suspension and steering systems used in AFNR power, structural, and technical systems.	
Topic 9.5	<i>Use control, monitoring, geospatial, and other technologies in AFNR power, structural, and technical systems.</i>		
	Student Competencies		
	9.5.1	APPLY COMPUTER AND OTHER TECHNOLOGIES (E.G., ROBOTICS, CNC, UAS, ETC.) TO SOLVE PROBLEMS AND INCREASE THE EFFICIENCY OF AFNR SYSTEMS.	
	9.5.1.1	Research and categorize computer technologies used to solve problems and increase efficiency in AFNR systems.	
	9.5.1.2	Examine and summarize the specific intent of technologies used to solve problems and increase the efficiency of AFNR systems (e.g., robotics, UAS, CNC, etc.).	
	9.5.1.3	Analyze data using computer programs and other current technologies used in AFNR systems.	
	9.5.1.4	Calculate the change in efficiency after using technologies in AFNR systems.	
	9.5.2	PREPARE AND/OR USE ELECTRICAL DRAWINGS TO DESIGN, INSTALL, AND TROUBLESHOOT ELECTRONIC CONTROL SYSTEMS IN AFNR SETTINGS.	
	9.5.2.1	Examine and categorize electrical control system components used in AFNR systems (e.g., transistors, relays, HVAC, logic controllers, etc.).	
	9.5.2.2	Differentiate between the purpose of electrical sensors and controls used in AFNR power, structural, and technical systems.	

	9.5.2.3	Research and summarize the importance of AFNR power, structural, and technical control systems using programmable logic controllers (PLC) and/or other computer-based systems.
	9.5.2.4	Analyze schematic drawings for electrical control systems used in AFNR systems.
	9.5.2.5	Interpret maintenance schedules for electrical control systems used in AFNR power, structural, and technical systems.
	9.5.2.6	Assess the functions of AFNR power, structural, and technical control systems using programmable logic controllers (PLC) in agricultural production and manufacturing.
	9.5.3	APPLY GEOSPATIAL TECHNOLOGIES TO SOLVE PROBLEMS AND INCREASE THE EFFICIENCY OF AFNR SYSTEMS.
	9.5.3.1	Research and summarize the impact of utilizing geospatial technologies (i.e., GPS, GIS, remote sensing, telematics, etc.) in AFNR systems.
	9.5.3.2	Examine the components of precision technologies used in AFNR systems.
	9.5.3.3	Analyze and interpret trends in data collected utilizing geospatial technologies.
	9.5.3.4	Analyze and calculate the economic impact of utilizing precision technologies (e.g., GPS/GIS) in AFNR systems.

Career Ready Practices (CRP)

FFA & SUPERVISED AGRICULTURAL EXPERIENCE

CRP 1	Act as a responsible and contributing citizen and employee.
CRP 2	Apply appropriate academic and technical skills.
CRP 3	Attend to personal health and financial well-being.
CRP 4	Communicate clearly, effectively, and with reason.
CRP 5	Consider the environmental, social, and economic impacts of decisions.
CRP 6	Demonstrate creativity and innovation.
CRP 7	Employ valid and reliable research strategies.
CRP 8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP 9	Model integrity, ethical leadership, and effective management.
CRP 10	Plan education and career path aligned to personal goals.
CRP 11	Use technology to enhance productivity.
CRP 12	Work productively in teams while using cultural/global competence.